From: Green, Kimberly
Sent: Thursday, March 12, 2020 3:36 PM
To: Wells, Russell Douglas
Subject: Draft Request for Additional Information for WBN2 Request Measurement Uncertainty Recapture Power Uprate (L-2019-LLS-0000)
Attachments: WBN2 MUR Draft RAI.docx

Dear Mr. Wells,

By letter dated October 10, 2019 (Agencywide Documents Access and Management System Accession No. ML19283G117), Tennessee Valley Authority (TVA) submitted a license amendment request for the Watts Bar Nuclear Plant, Unit 2. The proposed amendment would increase the authorized core power level by approximately 1.4 percent rated thermal power from 3411 megawatts thermal (MWt) to 3459 MWt. Additionally, the proposed amendment would revise Technical Specification (TS) 1.1, "Definitions," and TS 5.9.5b, "Core Operating Limits Report (COLR)," to reflect changes to the power level and use of the leading edge flowmeter (LEFM).

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing your submittal and has identified areas where additional information is needed to complete its review. Attached, please find a draft request for additional information (RAI).

The draft RAI is being sent to ensure that the request is understandable and the regulatory basis for the request is clear. This email and the attachment do not convey or represent an NRC staff position regarding TVA's request.

Please let me know if TVA needs a call to clarify the NRC staff's request.

Regards,
Kim Green
(301) 415-1627
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DRAFT REQUEST FOR ADDITIONAL INFORMATION

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT, UNIT 2

DOCKET NO. 50-391

MEASUREMENT UNCERTAINTY RECAPTURE POWER UPRATE

By letter dated October 10, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19283G117) to the U.S. Nuclear Regulatory Commission (NRC), Tennessee Valley Authority (TVA) submitted a license amendment request (LAR) for the Watts Bar Nuclear Plant, Unit 2 (WBN2). The proposed amendment would increase the authorized core power level by approximately 1.4 percent rated thermal power from 3411 megawatts thermal (MWt) to 3459 MWt. Additionally, the proposed amendment would revise Technical Specification (TS) 1.1, "Definitions," and TS 5.9.5b, "Core Operating Limits Report (COLR)," to reflect changes to the power level and use of the leading edge flowmeter (LEFM).

RAI SNSB-Containment-1:

To meet General Design Criterion (GDC) 50, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," (SRP) Section 6.2.1.3 specifies that the reactor power should be considered when the mass and energy release from the break is under evaluation. Please provide the power level (reactor core or NSSS) for each of the following analyses for both current licensing and the proposed 1.4% measurement uncertainty recapture (MUR) power uprate conditions:

(a) Short-Term LOCA Mass and Energy Release Analysis
(b) Loop Subcompartment Analysis
(c) Reactor Cavity Analysis
(d) Pressurizer Enclosure Analysis
(e) Maximum Reverse Pressure Differential Analysis

RAI SNSB-Containment-2:

TVA stated that the loop subcompartment analysis is based on the use of Zaloudek correlation to calculate the subcooled water release. The current licensing basis reactor coolant temperatures for the Zaloudek correlation calculation are 555.2 °F and 617.1 °F for core/vessel inlet and outlet, respectively. The reactor coolant temperatures for 1.4% MUR power uprate are 557.3 °F and 619.1 °F core/vessel inlet and outlet, respectively. TVA stated that the use of lower reactor coolant temperatures will lead to higher critical mass flux from the reactor coolant system break. Hence, TVA determined that the current licensing basis mass and energy release would bound the mass and energy release for the 1.4% MUR power uprate.

However, TVA also stated in the Reactor Cavity Analysis section in the LAR that the 1.4% MUR power uprate would increase the break's critical mass flux by 3.6% as based on the Zaloudek correlation. Apparently, for the same application of Zaloudek correlation with the same reactor coolant temperature at reactor vessel inlet break, there exists contradictive conclusions in the

comparison of critical mass flux between these two reactor power conditions (i.e., current licensed power versus 1.4% MUR power uprate) from these two analyses (i.e., loop subcompartment versus reactor cavity).

SRP Section 6.2.1.4 applies the GDC 50 requirements to postulated line break to assure that the mass and energy release should be appropriately determined first. Please explain and resolve the contradictive determinations for the mass and energy release.

RAI SNSB-Containment-3:

The worst break possible in the pressurizer enclosure, as described in Final Safety Analysis Report, as updated (UFSAR) Section 6.2.1.3.9 (ADAMS Accession No. ML19336A067), is a double-ended rupture of the 6-inch (approximate area of 0.1963 square feet (ft^2)) spray line. The rupture is assumed to occur at the top of the enclosure. However, TVA stated that the as-built break is located at either cold leg spray nozzle or pressurizer spray nozzle with areas of 0.0645 ft^2 or 0.08727 ft^2, respectively.

SRP Section 6.2.1.2 applies the GDC 4 requirements to postulated line break to assure that the compartment structure and systems would be protected from the impact of a high energy line break. Please provide justification and the supporting analysis for the change of break from the 6-inch spray line to pressurizer spray nozzle. Include an explanation for why the break is assumed to only occur at the nozzle, or that a break cannot occur in the pressurizer spray line.

RAI SNSB-RCS-1:

Page E2-15 of Enclosure 2 to the LAR indicated that for events that are departure from nucleate boiling (DNB) limited or for that Revised Thermal Design Procedure (RTDP) is used, the transient analyses assumed 3475 MWt as initial power level (representing the nominal uprated power of 3459 MWt (101.4% of 3411 MWt), plus a reactor coolant pump (RCP) net heat input of 16 MWt). For events that are not DNB limited or for that the RTDP was not applied, the analyses were performed at initial conditions obtained by adding the bounding steady-state errors to nominal values in such a manner to maximize the impact on the limiting parameter. TVA described each analysis briefly for the UFSAR Chapter 15 events in Item II.1.D.iii of Enclosure 2 to the LAR and provided in Table II.1-1 the power levels assumed in the analyses of the UFSAR Chapter 15 events to support the MUR power uprate application. TVA indicated that the analyses of record (AORs) for UFSAR Chapter 15 events were performed at power levels equal to or greater than the MUR uprated power level and claimed that the AORs reflected in the WBN2 UFSAR were unaffected by the MUR power level and remained acceptable for WBN2 MUR power uprate to meet the requirements of GDCs 10, 15 and 10 CFR 50.46.

The NRC staff compared the power levels shown in Table II.1-1 with that in the most recent version of WBN2 UFSAR TABLE 15.1-2 (ADAMS Accession No. ML19176A135), “Summary of Initial Conditions and Computer Codes Used,” and found that that the power levels in Table II.1-1 assumed in the analyses supporting the MUR power uprate application are equal to or greater than that listed in WBN UFSAR Table 15.1-2 for the analyses of most events. In Table 1 below, the NRC staff identified the power levels that were different for the events listed in WBN UFSAR Table 15.1-2 for the AOR and Table II.1-1 in the LAR. To aid the review, NRC staff is requesting the following items:

a. Confirm that the power levels for the analysis of the events listed in WBN UFSAR Table 15.1-2 (ADAMS Accession No. ML191764135) have been updated to represent the AOR of WBN (at the MUR power level).
b. If the events in Table 15.1-2 were not updated, provide the updated NRC-approved UFSAR Table 15.1-2 to demonstrate that the power levels assumed in the AORs bound the power level for the MUR power uprate application.
c. If the events in Table 15.1-2 were not analyzed at the MUR power level, provide the results of the reanalyses for those events. Otherwise, for each of those reanalyses previously approved by the NRC, provide a reference of the NRC safety evaluations approving the reanalyses.

Table 1 Power Levels Used in the UFSAR Chapter 15 Analyses

Event No. (Shown in Table II.1-1 of Enclosure 2) UFSAR Section No. Event Title	**Analytical Power Level (MWt) from Table II.1-1 of Enclosure 2 (ADAMS 19283G119)**	**Analytical Power Level MWt) from WBN UFSAR TABLE 15.1-2 (ADAMS ML19176A135)**
(2) UFSAR 15.2.2 Uncontrolled Rod Cluster Control Assembly Bank Withdrawal at Power	3475 (1.014 % of 3411 MW plus 16 MW RCP heat)	3425
(3) UFSAR 15.2.3 Rod Cluster Control Assembly Misalignment	3475	3425
(4) UFSAR 15.2.4 Uncontrolled Boron Dilution	0 and 3475	0 and 3425
(8) UFSAR 15.2.8 Loss of Normal Feedwater	3479 (1.02 % of 3411 MW plus 16 MW RCP heat	3475
(9) UFSAR 15.2.9 Coincident Loss of Onsite and External (Offsite) AC Power to the Station – Loss of Offsite Power to the Station Auxiliaries	3475	This event is not included in the FSAR Table.
(10) UFSAR 15.2.10 Excessive Heat Removal Due to Feedwater System Malfunctions	3475	3425
(11) UFSAR 15.2.11 Excessive Load Increase Incident	3475	Not Available (NA)
(12) UFSAR 15.2.12	3475	3425

Event No. (Shown in Table II.1-1 of Enclosure 2) UFSAR Section No. Event Title	**Analytical Power Level (MWt) from Table II.1-1 of Enclosure 2 (ADAMS 19283G119)**	**Analytical Power Level MWt) from WBN UFSAR TABLE 15.1-2 (ADAMS ML19176A135)**
Accidental Depressurization of the Reactor Coolant System		
(15) UFSAR 15.2.15 Chemical and Volume Control System Malfunction During Power Operation	3475	NA
(16) UFSAR 15.3.1 Loss of Reactor Coolant from Small Ruptured Pipes or from Cracks in Large Pipes Which Actuate the Emergency Core Cooling System	3480	3475
(18) UFSAR 15.3.3 Inadvertent Loading of a Fuel Assembly into an Improper Position	3425	3425
(21) UFSAR 15.3.6 Single Rod Cluster Control Assembly Withdrawal at Full Power	3475	3425
(22) UFSAR 15.4.1 Major Reactor Coolant System Pipe Ruptures (Loss of Coolant Accident)	3479.8	3475
(24) Not in UFSAR Steam Line Break with Coincident Rod Withdrawal at Power	3475	NA
(25) UFSAR 15.4.2.2 Major Rupture of a Main Feedwater Pipe	3475	3425
(26) UFSAR 15.4.3 Steam Generator Tube Rupture	3475	3427
(29) UFSAR 15.4.6	0 and 3475	0 and 3411

Event No. (Shown in Table II.1-1 of Enclosure 2) UFSAR Section No. Event Title	Analytical Power Level (MWt) from Table II.1-1 of Enclosure 2 (ADAMS 19283G119)	Analytical Power Level MWt) from WBN UFSAR TABLE 15.1-2 (ADAMS ML19176A135)
Rupture of a Control Rod Drive Mechanism Housing (Rod Cluster Control Assembly Ejection)		
(30) Not in UFSAR Anticipated Transients Without Scram	3479 (102% of 3411)	NA

RAI SNSB-RCS-2:

Event 18 in Table II.1-1, "Inadvertent Loading of a Fuel Assembly into an Improper Position," showed a power level of 3425 MWt was assumed as the initial power level for the transient analysis, and page E2-20 for Event 18 further stated that "the AOR for this analysis is reflected in the WBN UFSAR and remains acceptable for WBN Unit 2 MUR power uprate." As shown in Table 1, the AOR in the WBN UFSAR for Event 18 was based on a power level of 3425 MWt, which is lower than the nuclear steam supply system power of 3475 MWt for the MUR uprated power level.

Justify the above quoted statement indicating that the AOR for this analysis (based on the power level of 3425 MWt) remains acceptable for the WBN2 MUR power uprate level (of 3475 MWt).

RAI NCSG-1:

The guidance in NRC Regulatory Issue Summary (RIS) 2002-03, "Guidance on the Content of Measurement Uncertainty Recapture Power Uprate Applications," recommends that a licensee provide information for its flow-accelerated corrosion (FAC) program as part of its license amendment request (LAR). The staff's acceptance criteria for FAC-related reviews are based on maintaining the minimum acceptable wall thickness for components susceptible to FAC.

Section IV.1.E.iii, "Flow Accelerated Corrosion Program," of the LAR states that the Watts Bar Unit 2 (WBN2) FAC program is based on the "…latest revision of the Electric Power Research Institute (EPRI) NSAC-202L, 'Recommendations for an Effective Flow-Accelerated Corrosion Program.'"

In order for the NRC staff to have reasonable assurance the FAC program will continue to manage FAC at the MUR power uprate conditions, the staff needs to ensure the WBN2 licensing basis adequately describes the FAC program. Clarify which revision of NSAC-202L is currently part of the WBN2 licensing basis and provide the basis for using this revision.

RAI NCSG-2:

Table IV.1.E-1, "Wear Rate Analysis for Lines with an Expected Increase in Wear Post-MUR Power Uprate," of the LAR provides a wear rate analysis to assess the impacts of the MUR power uprate on certain components susceptible to FAC at WBN2. However, the table appears to provide wear rate values averaged over a given line. While the overall increase in wear rate

for a line modeled in CHECWORKS™ may not be significant, individual susceptible components within the line may have significant projected increases in wear rate.

In order to obtain reasonable assurance that components within the lines described by the licensee will not experience significant degradation at the MUR power uprate conditions, the NRC staff requests wear rate values for individual susceptible components in these lines that will experience the greatest increase in wear rate due to the MUR power uprate conditions. Additionally, if any of these components are expected to have significantly increased wear rates, describe how the current FAC program will manage this reduction in component thickness.

RAI NCSG-3:

SRP Section 6.1.2, "Protective Coating Systems (Paints) – Organic Materials," Revision 3 (ADAMS Accession No. ML063600399), provides the NRC staff guidance to ensure coating systems used inside containment are evaluated to determine suitability for design basis accident (DBA) conditions. This guidance directs the reviewer to verify coating monitoring and maintenance procedures are capable of ensuring that coatings will not fail and become a debris source for the emergency core cooling system. This guidance also instructs the reviewer to determine the suitability of the protective coatings in the DBA environment when exposed to high temperatures, pressures, and radiation dose.

Section VII.6.B, "Containment Coatings Program," of the LAR discusses the current licensing basis for the WBN2 containment coatings program as well as the DBA qualifications of the coatings in containment. However, the staff requests the following clarification on both the licensing basis as well as the DBA qualifications for coatings in containment:

a. UFSAR Section 6.1.4, "Degree of Compliance with Regulatory Guide 1.54 for Paints and Coatings Inside Containment," states "TVA agrees with Regulatory Guide 1.54, except the endorsement to [American National Standards Institute] ANSI N101.4 in paragraph C.1" [ADAMS Accession No. ML19336A067]." However, the next paragraph states that applicable provisions in ANSI N101.4, "Quality Assurance for Protective Coatings Applied to Nuclear Facilities," are incorporated into the coatings program. Clarify which parts of the regulatory guidance and other standards apply to the containment coatings program at WBN2.

b. For the staff to verify that the qualifications of containment coatings are still bounding for the proposed MUR DBA conditions, provide a comparison of DBA conditions (e.g., temperature, pressure, dose) to the qualification conditions for the containment coatings.

RAI NCSG-4

The bases for WBN2 Technical Specification 3.4.17, "SG Tube Integrity" (ADAMS Accession No. ML13357A054), state that the basis for the WBN2 Steam Generator Program is Nuclear Energy Institute (NEI) 97-06, "Steam Generator Program Guidelines," and its referenced EPRI Guidelines. These referenced EPRI Guidelines include the EPRI "Pressurized Water Reactor [PWR] Primary Water Chemistry Guidelines." The EPRI PWR Primary Water Chemistry Guidelines contain limits on specific impurities for primary water chemistry and associated actions if these impurity limits are not met.

In order to ensure the integrity of the steam generator (SG) tubes can be maintained at MUR power uprate conditions, the NRC staff reviewed the primary water chemistry program. UFSAR

Table 5.2-10, “Reactor Coolant Water Chemistry Specifications,” provides a maximum concentration of chlorides and fluorides of 0.15 parts per million (ppm) and states that the concentration of oxygen will be maintained below 0.1 ppm. These values are greater than EPRI Primary Water Chemistry Guidelines, Revision 7, action level 1 limits for primary water chemistry parameters and may contribute to degradation of Alloy 600 SG tubes. Provide the justification for why operations at the MUR power uprate conditions will be able to maintain SG tube integrity with the primary water chemistry limits described in the WBN2 UFSAR.

EENB RAIs

Regulatory Criteria:

10 CFR 50.49(e)(1) requires that the time-dependent temperature and pressure at the location of the electric equipment important to safety must be established for the most severe design basis accident during and following which this equipment is required to remain functional.

10 CFR 50.49(b)(2) requires qualification of nonsafety-related electric equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions specified in subparagraphs (b)(1)(i)(A) through (C) of paragraph (b)(1) of 10 CFR 50.49 by the safety-related equipment.

Issue:

In the LAR, TVA noted that they have evaluated the impact of the proposed MUR power uprate on the Environmental Qualification (EQ) of equipment. TVA asserted that the results of their evaluations showed that electrical equipment that is required to be environmentally qualified per 10 CFR 50.49 will remain qualified (i.e., bounded by the existing EQ). However, TVA did not provide enough detail for the staff to confirm their conclusion.

It is also unclear as to whether TVA considered the impact of the proposed change on qualified non-safety related equipment (under 10 CFR 50.49(b)(2)) whose failure under postulated environmental conditions could prevent satisfactory accomplishments of safety functions by the safety-related equipment.

RAI EENB-1:

In the LAR, TVA stated that:

> *The evaluation of the systems inside containment and in the MSVV for accident temperature and pressure conditions showed that the current design basis analyses were performed at 102% of 3411 MWt (i.e., 3479 MWt), which bounds the MUR power uprate. There is no EQ impact with respect to temperature or pressure due to the MUR power uprate. No areas transition from mild to harsh environments because of the MUR power uprate based on temperatures.*

Based on various statements in the LAR, it’s unclear to the NRC staff as to whether the existing accident analyses for all areas of the plant were performed at 102% rated thermal power (RTP) versus being limited to inside containment and the main steam valve vault. If the accident analyses performed at 102% RTP were limited to inside containment and the main steam valve vault, provide an evaluation that shows that the environmental qualification remains bounding for electric equipment located in areas of the plant that will experience parameter changes (i.e.,

increase in temperature, pressure, radiation, humidity, chemical spray, etc.) due to the proposed MUR power uprate.

RAI EENB-2:

In Enclosure 2 – V Electrical Equipment Design – V.1.C, “EQ of Electrical Equipment,” TVA stated that:

> *The TVA EQ Program addresses safety-related electrical equipment within the scope of 10 CFR 50.49 for WBN. The EQ program for WBN was reviewed to evaluate the impact of the MUR power uprate and it was determined that no programmatic changes are required. See Section II.1.D.iii (Item 32).*

Explain how you have assessed the impact of the proposed change on qualified non-safety related equipment (under 10 CFR 50.49(b)(2)) whose failure in postulated environmental conditions could prevent satisfactory accomplishments of safety functions by the safety-related equipment.

RAI EMIB-1

The WBN2 LAR does not provide any evaluation of snubbers (similar to pumps and valves) in the submitted WBN2 MUR power uprate application. Please describe the snubber evaluation and its results. If an evaluation was not performed, justify that the existing evaluation of the snubbers is bounding for the uprated power.

RAI EMIB-2

Regulatory Guide (RG) 1.20, “Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing,” Revision 4, provides guidance for addressing phenomena that can cause adverse flow effects (such as damaging vibration) to components (such as valves, pipe supports, and snubbers) in steam systems as a result of flow of steam over a branch line that generates an acoustic resonance. Nuclear Energy Institute (NEI) 08-10, “Roadmap for Power Uprate Program Development and Implementation,” Revision 0, references RG 1.20 in planning power uprates. Please indicate whether RG 1.20 is used for the WBN2 MUR, and, if not, describe the approach used to address potential acoustic resonance phenomena.